

Maritime Defense Protection UWB Communications

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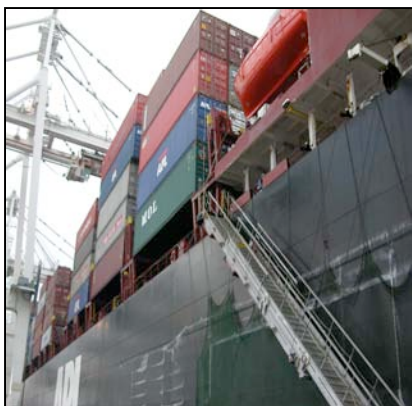
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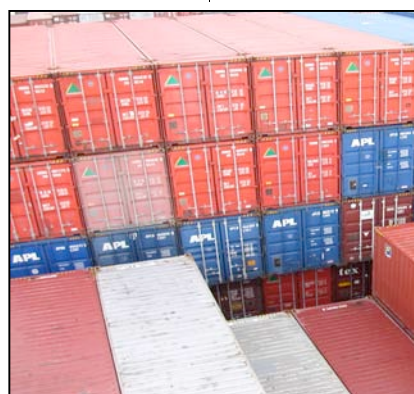
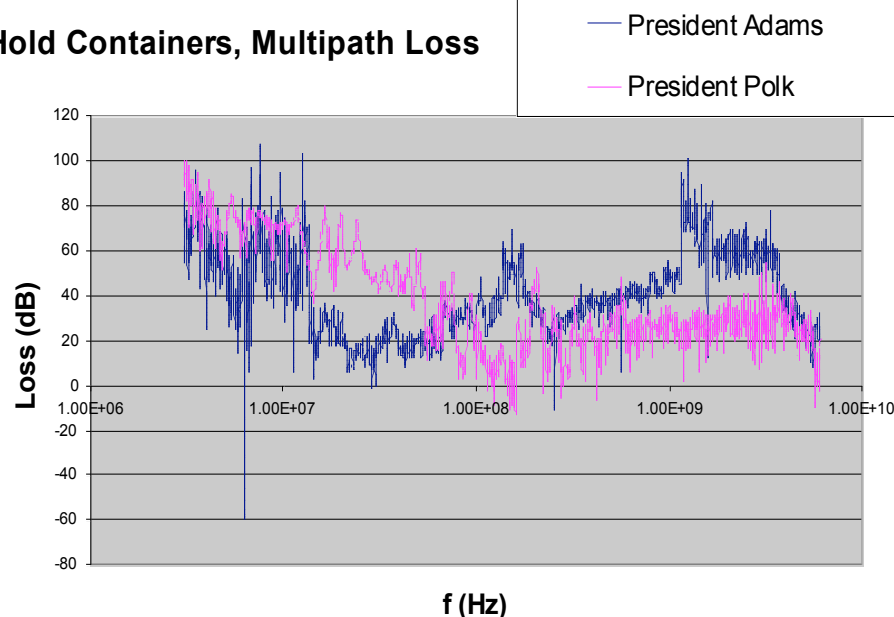


No single frequency will work out of cargo holds/engine rooms

- American Presidents Line
- Port of Oakland
- January 2003

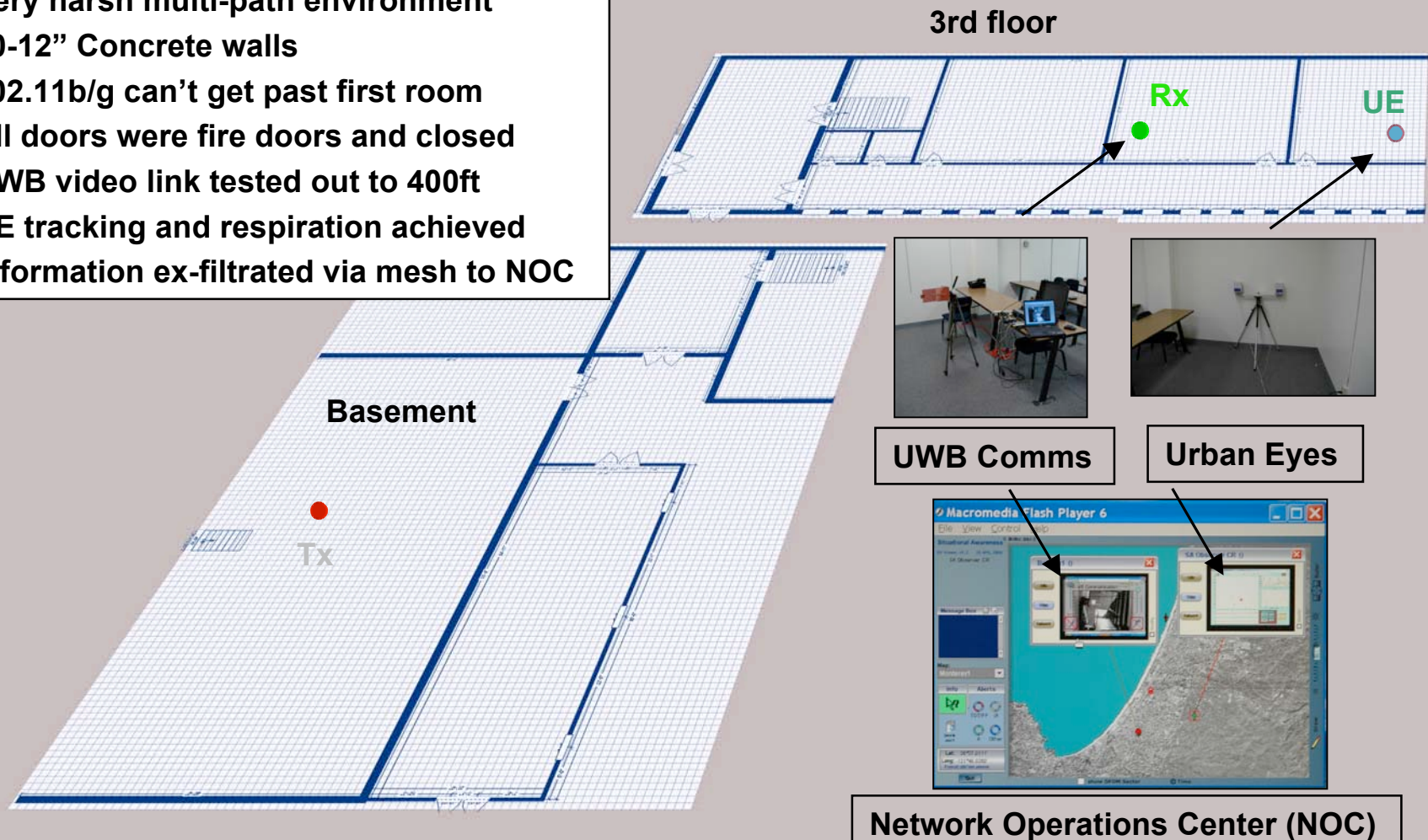


Hold Containers, Multipath Loss



LLNL UWB video link has proven to be reliable through harsh environments

- Very harsh multi-path environment
- 10-12" Concrete walls
- 802.11b/g can't get past first room
- All doors were fire doors and closed
- UWB video link tested out to 400ft
- UE tracking and respiration achieved
- Information ex-filtrated via mesh to NOC



National Defense Reserve Fleet provides an ideal testing ground for UWB

- Suisun Bay - Benicia, California
- Under custody of the Maritime Administration (MARAD)

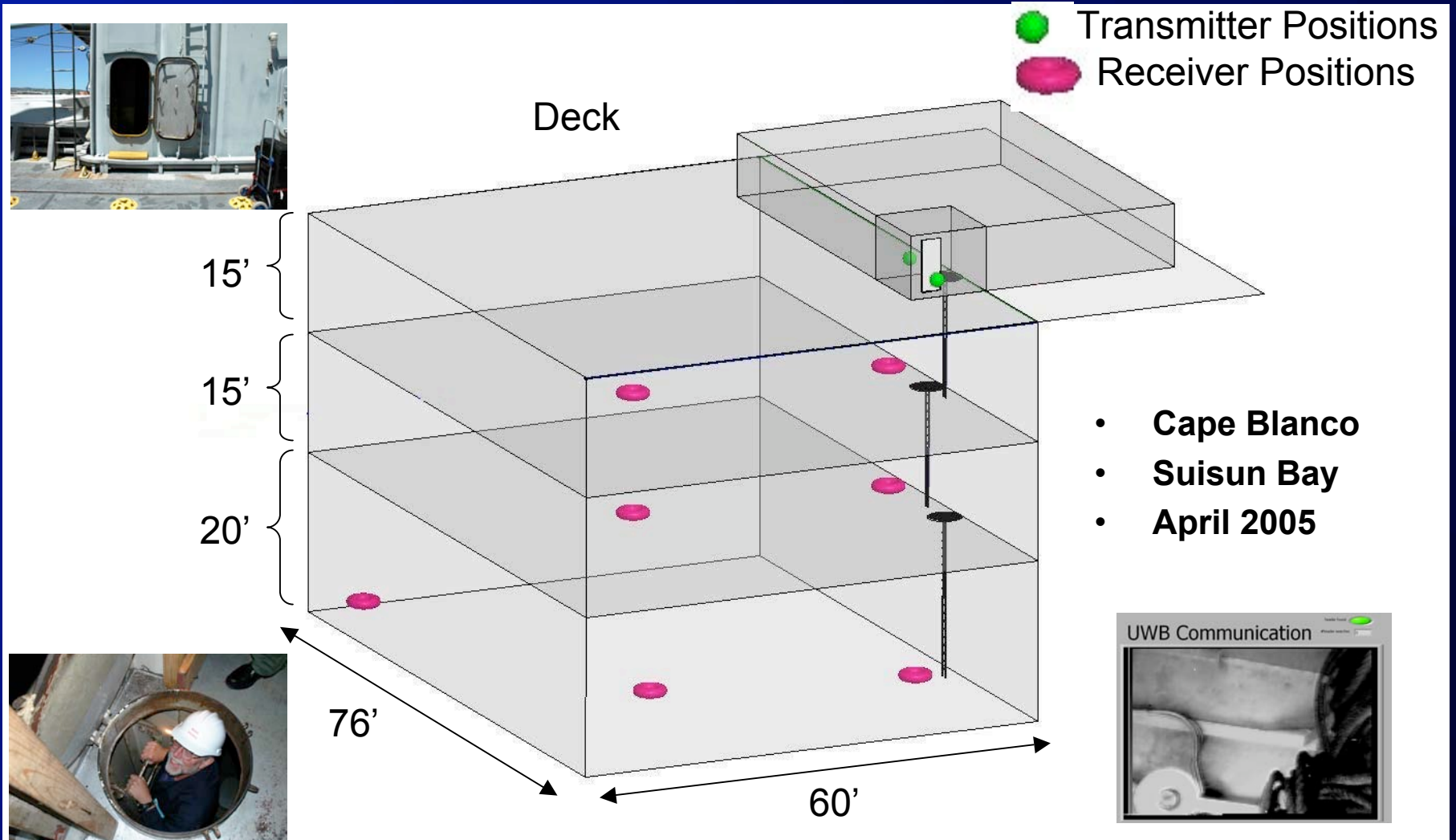


- Inactive reserve of ships that could be activated during national emergencies

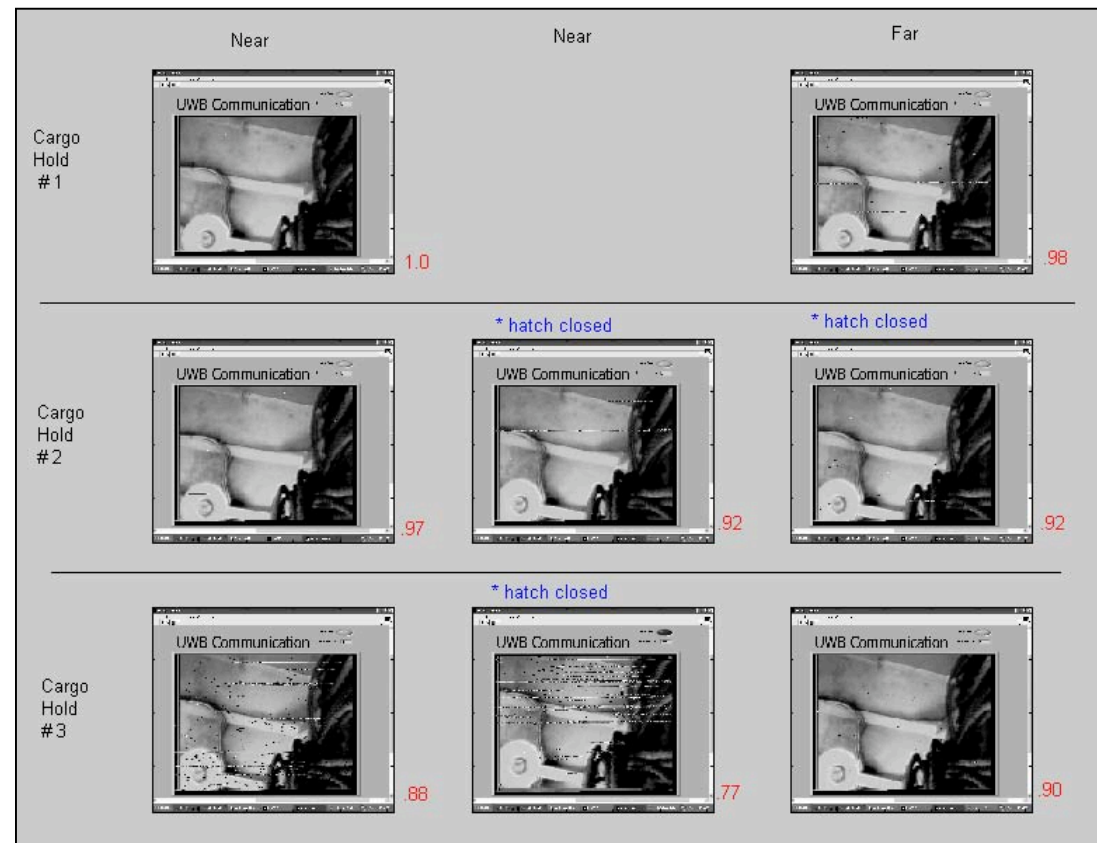


- Cape Blanco
- Built: 1966
- 540 x 76 x 33 feet

UWB video communication worked even with hatches closed



A comparison of video quality from different locations shows robustness



- Signal travels though cracks in the steel hold doors

Video link is also maintained when going below deck into engine room

Transmitter Screenshot

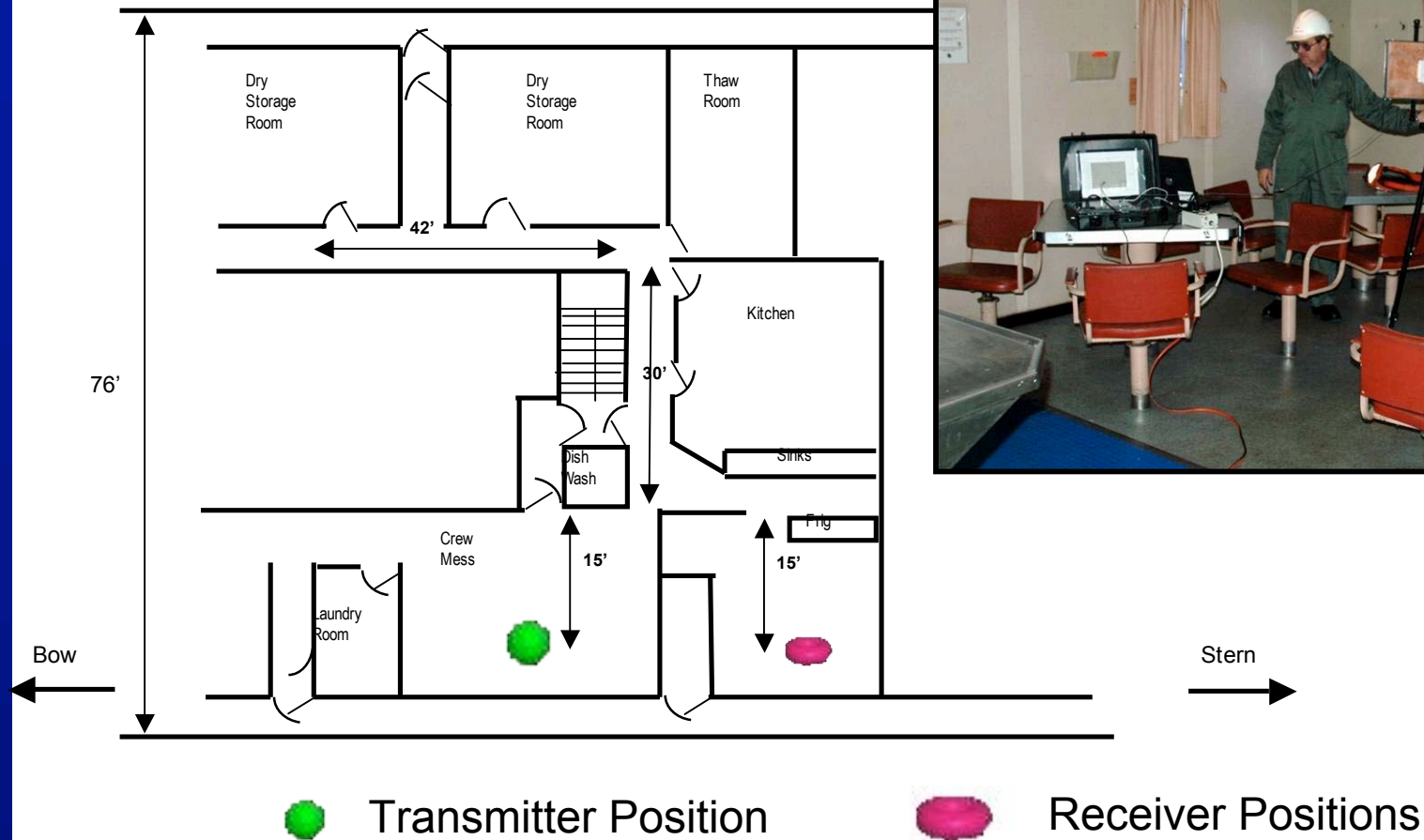


Receiver Screenshot

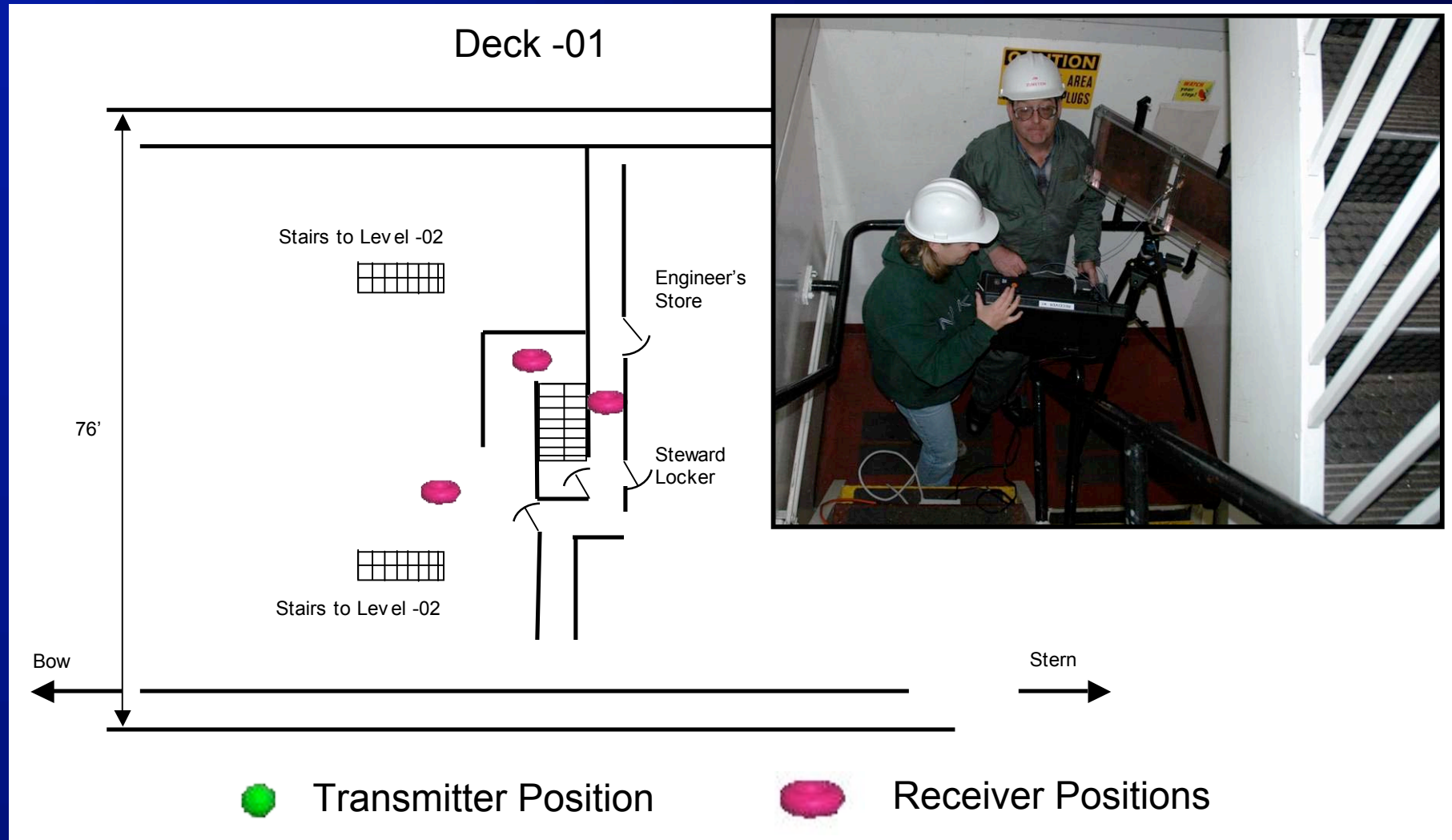


Crew mess hall in route to engine room

Deck 00

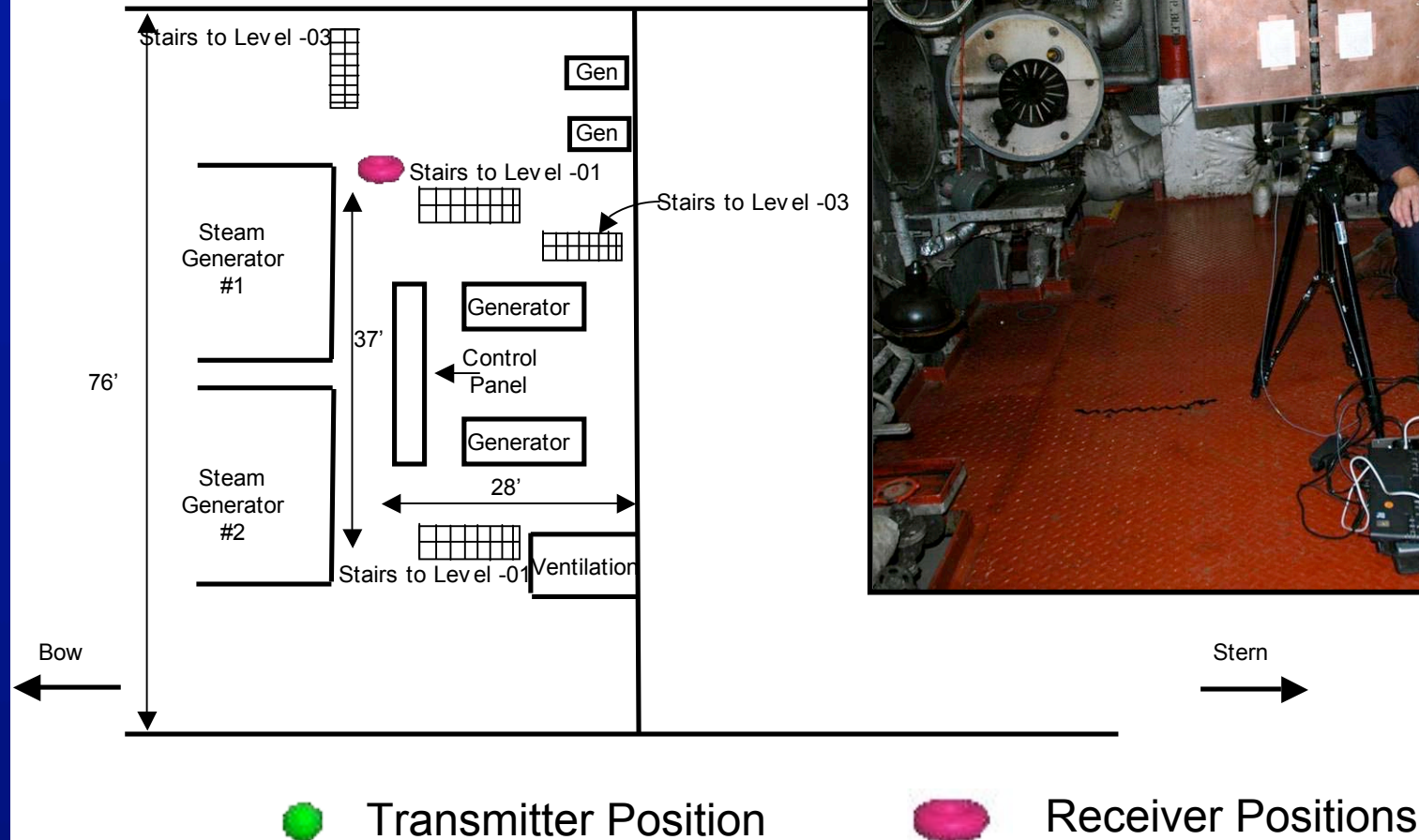


Crew mess hall in route to engine room

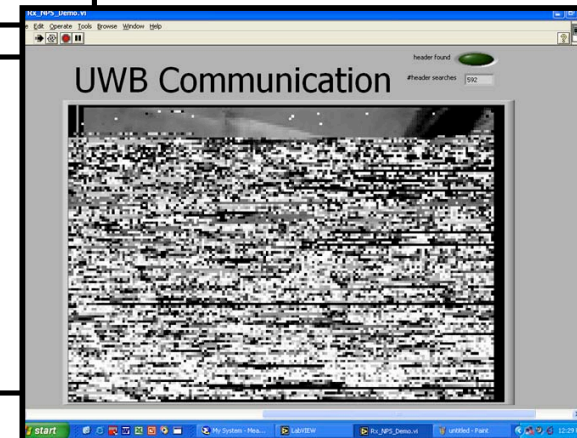
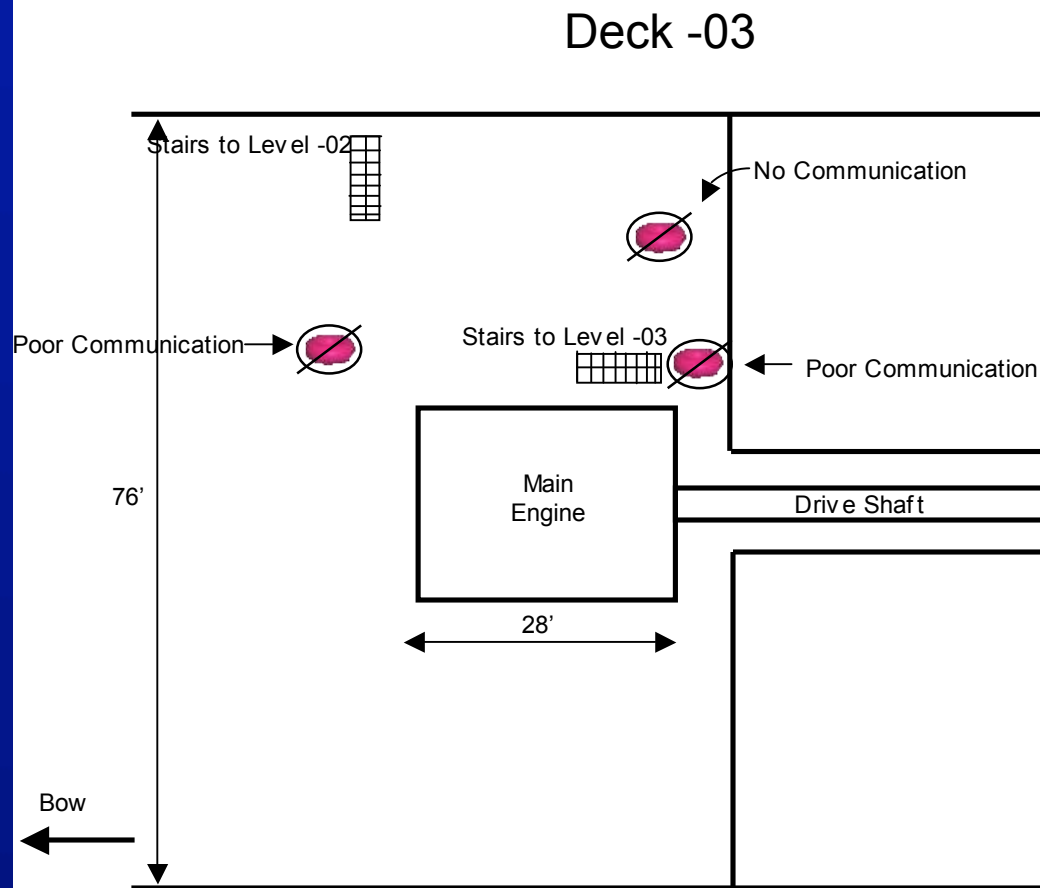


Crew mess hall in route to engine room

Deck -02



Crew mess hall in route to engine room



Transmitter Position



Receiver Positions

Without forward error correction, system works reliably over harsh environments

